

# Inherent uncertainties in radiation simulations of the influence of clouds on the climate

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The energy equilibrium between solar and terrestrial radiation defines the state of the climate. When the energy absorbed from incoming radiation is larger than the energy lost through outgoing radiation, the global average temperature rises, and temperature declines in the reverse case. To study the influence of radiation on the climate, the commonly applied method is to use GCMs (General Circulation Models) to simulate the results of a current or future scenario. However, the methods to calculate the radiation field, especially where clouds exist, cause different uncertainties in the flux and heating rate simulations. Due to the highly anisotropic scattering properties of clouds, accurate flux and heating rate calculations are time consuming. Therefore, GCMs use approximations [1,2] as a compromise between accuracy and efficiency of radiation calculations.

In this study, we quantify the uncertainties in the flux and heating rate calculations by using different radiation simulation methods in both visible and infrared spectral bands. Moreover, the potential impacts on climate projections due to radiation simulation uncertainties will be presented by using the cloud microphysical and optical properties obtained from MODIS (Moderate Resolution Imaging Spectroradiometer) retrieval products.

## References

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- [2] Costa, S. M. S., and Shine, K. P., 2006: An estimate of the global impact of multiple scattering by clouds on outgoing long-wave radiation. *Q. J. R. Meteorol. Soc.* **132**, 885–895.

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